

CLAIMS

1. A fuel injection valve in which a nozzle hole is formed on a metering plate and fuel flowing on a face on the upstream side of the metering plate is injected  
5 outside of a face on the downstream side of the metering plate, the fuel injection valve comprising:

a vortex flow generator means for making a flow of fuel passing in the nozzle hole form into a vortex flow, wherein the vortex flow generator means is  
10 provided on the upstream side of the metering plate.

2. A fuel injection valve according to claim 1, wherein the vortex flow generator means is a vortex flow generator groove provided on a face on the upstream side of the metering plate so that the vortex flow generator  
15 groove can be connected to a wall face of the inlet of the nozzle hole, and a main stream of fuel flowing in the groove is directed to a position deviating from a center of the nozzle hole.

3. A fuel injection valve according to claim 2, wherein the following relations are established,  
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$$L \times 1/5 < F < L \times 2/3$$

$$D \times 1/2 < N < D \times 3$$

$$D \times 1/5 < H < D \times 2/3$$

$$D \times 1/5 < B < D \times 1/2,$$

25 where F is depth of the vortex flow generator groove, N is length, H is width, and B is an offset of the center line in the longitudinal direction from the center of the nozzle hole.

4. A fuel injection valve according to claim 2, wherein the vortex flow generator groove is formed so  
30 that a flow of fuel from the outer circumferential side of the metering plate can be guided by the groove.

5. A fuel injection valve according to claim 2, wherein a plurality of vortex flow generators are  
35 provided for one nozzle hole.

6. A fuel injection valve according to claim 2,

wherein depth of the vortex flow generator groove is formed to be constant, increased or decreased toward the nozzle hole.

5           7.    A fuel injection valve according to claim 2, wherein the shape of the vortex flow generator groove is a rectangle, a semi-ellipse, a triangle having one vertex on the nozzle hole side, a triangle having one vertex on the end portion side or a comma-shape curved in the direction of revolution of fuel.

10           8.    A fuel injection valve according to claim 2, wherein the vortex flow generator groove has a function of giving a pre-rotation to fuel so that fuel can be rotated when it flows into the nozzle hole.

15           9.    A fuel injection valve according to claim 1, wherein the vortex flow generator means is a guide protrusion formed on an upper face of the metering plate.

20           10.   A fuel injection valve in which a nozzle hole is formed on a metering plate, fuel flowing on a face on the upstream side of the metering plate is injected outside of a face on the downstream side of the metering plate and a needle having a forward end face opposed to the metering plate is arranged on the upstream side of the metering plate, the fuel injection valve comprising:

25               a vortex flow generator means for making a flow of fuel passing in the nozzle hole form into a vortex flow, wherein the vortex flow generator means is guide groove formed on the forward end face of the needle.